Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 37

# ROWAN LAKE AREA

## (NTS 52F/SW)

## Districts of Kenora and Rainy River

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ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES
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By
M.A. Rowe

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Hon. James A.C. Auld
Minister

Dr. J.K. Reynolds
Deputy Minister

Ministry of Northern Affairs

Hon. Leo Bernier
Minister

Art Herridge
Deputy Minister

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## MAP
## (accompanying report)


Map 5060 (coloured) – Northern Ontario Engineering Geology Terrain Study Data Base Map, Rowan Lake (NTS 52F/SW). Scale 1:100 000.

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# ROWAN LAKE AREA

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Districts of Kenora and Rainy River

by

M.A. Roed[1]

## 1.0 INTRODUCTION

This report and the accompanying map present the results of an engineering geology terrain study for the Rowan Lake area, Districts of Kenora and Rainy River. The area, which covers NTS block 52F/SW, lies between Latitudes 49°00'N and 49°30'N and Longitudes 93°00'W and 94°00'W. The report and map form part of a series of publications which provide similar terrain data for approximately 370 000 $km^2$ of northern Ontario.

The purpose of this study is to provide an inventory of engineering geology terrain conditions that will serve as a basic data framework for engineering and resource planning activities, at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5060, accompanying this report).

Interpretation of 1974 black and white aerial photographs, at a scale of approximately 1:50 000, formed the basis of the terrain mapping process.

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[1]Consulting Geologist, Geo-analysis Limited, Ottawa, Ontario.

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The interpretation was compared to relevant published information for the study area. The area is largely inaccessible by road, but an automobile reconnaissance along Highway 71 served as a check on some aspects of the office studies. Thus, the Data Base Map represents an airphoto reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further discussion on the mapping techniques, legend format and possible uses of this engineering geology information is available in the Ontario Engineering Geology Terrain Study Users' Manual (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

Appreciation is expressed to the Ontario Geological Survey for providing a manuscript copy of the aggregate inventory map for the area, prepared by E.V. Sado.

## 2.0 GEOLOGIC SETTING

The Rowan Lake area is underlain by crystalline bedrock of Precambrian age, which is covered by a thin, discontinuous mantle of Quaternary surficial deposits. The area is dominated by extensive tracts of ridged and hilly rock terrain. Patches of ground moraine, hummocky moraine, and glaciolacustrine and glaciofluvial deposits are comparatively rare. Very little alluvium has been mapped, whereas organic terrain is widespread in small, poorly drained depressions.

### 2.1 BEDROCK GEOLOGY

The map-area, which lies within the Wabigoon Belt in the Superior Structural Province of the Canadian Shield, is underlain by two contrasting bedrock types, both of Early Precambrian age. The oldest rocks are supracrustal and comprise highly folded, curvilinear belts of mafic to felsic metavolcanics, with lesser amounts of metasediments, mafic and ultramafic intrusive rocks, and felsic igneous and metamorphic rocks. These belts dominate the western half and southeast corner of the area.

The remainder of the area is underlain by undifferentiated felsic igneous and metamorphic rocks. Northwest-trending diabase dikes of Middle to Late Precambrian age cut all other rock types in the area (Davies and Pryslak 1967).

An area of high mineral potential, particularly for nickel-copper, extends north from Isinglass Lake to the northern margin of the map-area. A belt, extending from Whitefish Bay in the west to Lower Manitou Lake in the east and concave northward, has high potential for copper-gold in the west and gold-silver in the east. Several other parts of the metavolcanic-metasedimentary belt have medium mineral potential, while the potential of the felsic igneous and metamorphic rocks is rated as "least" (Springer 1978).

## 2.2 QUATERNARY GEOLOGY

Northwestern Ontario has been affected by several stages of continental glaciation during the Pleistocene. However, only deposits of the last glaciation, the Laurentide of Wisconsinan age, are preserved in the Rowan Lake area. The ice began to advance approximately 100 000 years ago and travelled as far south as central Wisconsin before receding. The ice disappeared from the Rowan Lake area approximately 15 000 years ago (Prest 1970), Zoltai (1961) gives a more complete account of the glacial history of the region.

Widespread stagnation of the ice mass resulted in the deposition of a variety of surficial materials. Till was deposited directly by the ice in the form of ground moraine and hummocky moraine. Meltwater from the glacier formed glaciofluvial outwash deposits and accumulated in lowlands to form glacial lakes. To the west of the Rowan Lake area, these lakes grew in size and eventually coalesced to form an enormous body of water called Glacial Lake Agassiz. Deposits of glaciolacustrine silt and clay occur, primarily as subordinate landforms, in the northwestern and northeastern parts of the map-area. In the rugged rocky uplands characteristic of most of the area, the glacier overdeepened valleys, rounded off bedrock outcrops, and left scattered patches of moraine and boulders. The waters of Glacial Lake Agassiz may not have reached large parts of these uplands.

The complete disappearance of glacial ice and gradual draining or drying up of glacial lakes marked the end of the Pleistocene Stage of the Quaternary Period in the area. Since that time, approximately 9 000 years ago (Prest 1970), modern streams have developed alluvial flood plains and organic deposits have accumulated in wet depressions. These deposits are nonglacial in origin, and, together with the various glacial materials, comprise the variety of Quaternary unconsolidated deposits that forms a discontinuous mantle over the bedrock in the Rowan Lake area.

### 2.3 PHYSIOGRAPHY

Rolling hilly topography of moderate relief characterizes much of the map-area. Minor lowlands occur in the vicinity of Whitefish Bay in the northwest corner of the area and north of Manitou Stretch in the eastern part. Rock scarps are common, especially in ridged bedrock terrain (RR), and till ridges are apparent in places. An extensive series of scarps in the southwestern part of the area extends from Crow Lake southeast for 25 km to the Sabaskong River. Many bedrock landforms associated with similar escarpments are distinctly flat-topped and likely represent old erosion surfaces of Precambrian age. Elevations range from 323 m at Lobstick Bay of Lake of the Woods to 488 m in a rugged locality northwest of Barker Bay on Lower Manitou Lake.

## 3.0 ENGINEERING TERRAIN UNITS

Engineering terrain units are composed of a combination of various materials (unconsolidated and/or bedrock) which form recognizable landforms with certain engineering characteristics. Major terrain unit groups, and the engineering significance of each, are discussed in detail. These include bedrock terrain (RN, RR), moraine (MG, MH), glaciofluvial outwash (GO), and organic terrain (OT). Alluvial plains (AP) and glaciolacustrine plains (LP) are less significant terrain units and are discussed in less detail. A diagrammatic sketch of a typical terrain setting is given in Figure 1. Table 1 summarizes the characteristics and engineering significance of the major terrain units in the Rowan Lake area.

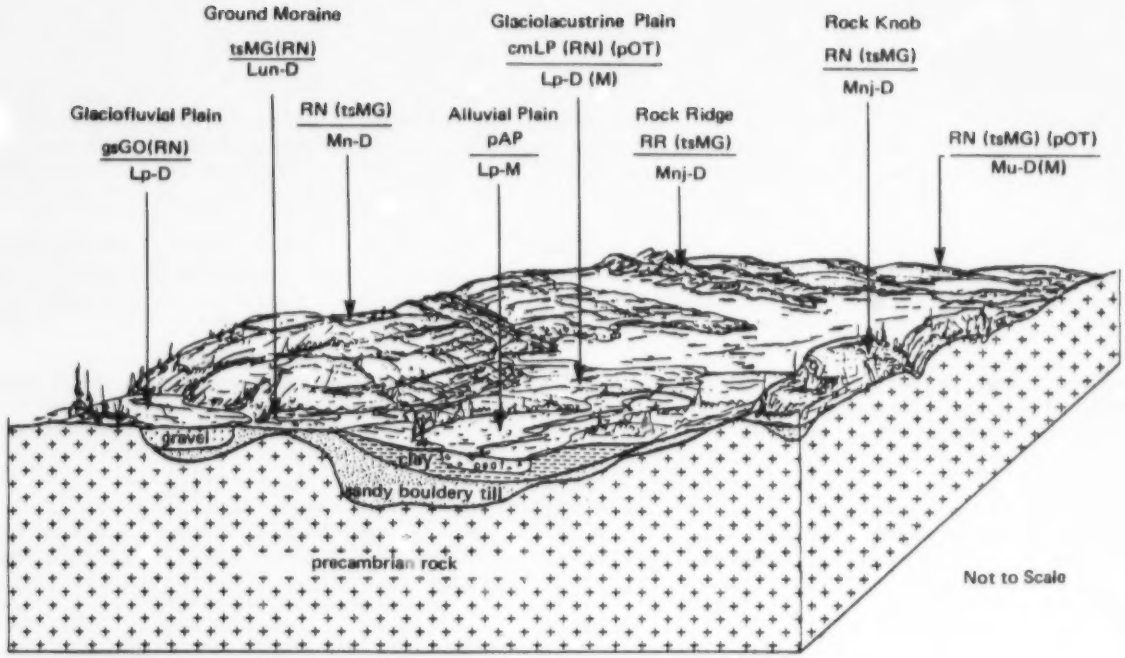


**FIGURE 1 – DIAGRAMMATIC SKETCH SHOWING TYPICAL TERRAIN TYPES AND THEIR REPRESENTATIVE LETTER SYMBOLS.**

**TABLE 1** | SUMMARY OF TERRAIN UNIT CHARACTERISTICS AND ENGINEERING SIGNIFICANCE, ROWAN LAKE AREA

| CLASSIFICATION | | ENGINEERING USE | | | | |
|---|---|---|---|---|---|---|
| **Terrain Unit and Location** | **Material; Relief; Topography; Drainage** | **General Construction** | **Transportation Routes** | **Waste Disposal** | **Groundwater Supply** | **Major Constraints** |
| **BEDROCK TERRAIN (RN, RR),** throughout the area | rock; low relief; undulating to ridged and rugged; drainage good | excavations and fill are necessary for most types of construction; blasting | extensive excavations and fill; aggregate in small pockets | unsuitable | deep wells provide supply for domestic use | rugged terrain; lack of aggregate; blasting often required |
| **GROUND MORAINE (MG),** scattered throughout the area | sandy till (ts); low to moderate relief; hummocky, reworked; drainage good | excavation and fill necessary for some types of construction | aggregate in local pockets | suitable where deposit is thick | poor to fair | deposits are too thin and discontinuous; rock knobs may occur |
| **HUMMOCKY MORAINE (MH),** south of Kagagi Lake and near Manitou Stretch | sandy till (ts); low relief; hummocky; drainage good | conditions are good for construction where material is thick | good conditions; aggregate in pockets | suitable for waste disposal where deposit is thick | fair | deposits are not widespread; large boulders in some places; rock knobs may occur; topography rough |
| **GLACIOFLUVIAL OUTWASH (GO),** in small pockets throughout bedrock terrain | sand and gravel (sg); low relief; planar; drainage mixed | good conditions except for possible high water table | aggregate readily available | generally unsuitable | excellent where deposits are thick | deposits are small and water table is high in most cases |

| | | | | | | |
|---|---|---|---|---|---|---|
| **GLACIOLACUSTRINE PLAIN (LP)**, in small pockets throughout the area | silty clay (cm); low relief; planar; drainage mixed | easy excavations but water table is high; poor construction materials | aggregate must be imported; frost susceptible soils | generally suitable | poor | frost susceptible; low bearing capacity; poor drainage; erosion |
| **ORGANIC TERRAIN (OT)**, in depressions throughout the area | peat (p); low relief; planar; drainage poor | low bearing capacity; highly frost susceptible; high compressibility | unsuitable for subgrade; drainage is poor | unsuitable | poor | frost susceptibility; low bearing capacity; poor drainage |

Comments: Alluvial plains (AP) consisting mainly of sandy peat are shown along streams in the southwest corner of the area; others occur along most streams, but are too small to map at this scale. Glaciolacustrine beaches (LB) occur along the flanks of bedrock knobs northeast of Whitefish Bay.

## 3.1 BEDROCK

Examples $\frac{RN(tsMG)\,(pOT)}{Mn\text{-}D(M)}$ $\frac{RR(tsMG)\,(pOT)}{Mnr\text{-}D(M)}$

Bedrock terrain consists of rugged or undulating hills (RN) and some linear ridges (RR). Hilly rock terrain is mainly of moderate local relief (M) and commonly contains patches and valley fills of either till (tsMG) or organic material (pOT). Bare bedrock occurs in many places, but a thin, discontinuous veneer of bouldery sandy till is widespread. Isolated clay plains occur in some low spots within this terrain (e.g. in the northwest and northeast corners of the map-area and southwest of Straw Lake in the southern part of the area). The unit is generally well drained (D), but depressions are invariably wet (W or M) during some parts of the year. A drill hole at Denmark Lake in the northwest-central part of the area intersected 150 feet of moraine material (Davies 1973), indicating that the bedrock surface has considerable relief in places and that unconsolidated material can be quite thick. A concentration of unusually large erratics was noted between Weisener and Stephen Lakes in the western part of the area (Davies and Morin 1976), as well as an extensive sand plain (sGO(pOT) (RN)) in the same vicinity.

Ridged bedrock terrain, which is widespread throughout the map-area, is developed in highly folded supracrustal stratified rocks. Scarps of bare bedrock, only a few of which are shown on the map, are particularly prominent in this unit. Depressions between the scarps are infilled with till and organic material, hence the symbol (RR (tsMG) (pOT)). Relief is generally moderate and the unit is well drained, except in depressions which are wet for much of the year.

The principal engineering significance of bedrock terrain is that it is difficult and expensive to excavate. Blasting is required for all subsurface excavations. Extensive cut-and-fill operations are required for transportation route construction in rugged terrain, in order to eliminate excessive horizontal and vertical alignments. High rugged slopes pose additional problems for general construction in some localities. Although there are small sand and gravel deposits in bedrock terrain that provide some construction material for low grade access roads, major transportation routes will require importation of suitable granular material.

Groundwater potential is generally poor, except in fault zones where it may be possible to obtain substantial quantities of water. Bedrock terrain is not suitable for septic system operation, except where there is a thick (at least 1.5 m) layer of suitable surficial material. The unit is not suitable for near-surface waste disposal.

## 3.2 MORAINE

Examples: $\frac{\text{tsMG/RN(sgGO) (RN)}}{\text{Mnw-D}}$ $\frac{\text{tsMH(RN)}}{\text{Mn-D}}$

Ground moraine (tsMG) and hummocky moraine (tsMH) composed of bouldery sandy till are not well developed in the Rowan Lake area. The largest units include patches of ground moraine around Fog Lake in the central part of the area and in the southeast corner of the area, a patch of hummocky moraine around Schistose Lake in the southwest-central part of the area, and a combined ground moraine and outwash unit around South Arrow Lake on the western margin of the area. Relief ranges from low (L) to moderate (M), the topography of most units is undulating (u) and hummocky (h), and they are generally well-drained. Deposits of till usually have thickness in excess of 3 m and overlie bedrock; rock knobs are a ubiquitous feature. Local patches of sand and gravel occur within the unit and most depressions contain wet organic deposits.

A clay till was reported by Zoltai (1961) west of the Rowan Lake area in the vicinity of Sioux Narrows. This unit may occur in places along the western edge of the map-area.

Moraine composed of sandy till is an excellent source of fill and, in places is beneficiated to produce aggregate. It has good foundation qualities and is usually well drained. Rock and organic deposits may occur, and in places the topography is rugged. Groundwater potential is poor to fair, and where the till is thick, this terrain is suitable for municipal waste disposal and septic drain tile fields.

## 3.3 GLACIOFLUVIAL

Examples: $\frac{\text{gGO}}{\text{Lp-M}}$ $\frac{\text{sGO(pOT)}}{\text{Lp-M}}$

Patches of glaciofluvial sand and/or gravel (sGO, sgGO) are widely separated and commonly occupy low terraces (ts) (e.g. near Mongus Lake) or the floors of minor valleys. Drainage ranges from dry to mixed (D-M) and relief is low. Some organic deposits are underlain by glaciofluvial material, especially in the western part of the area.

Sand and gravel of glaciofluvial origin are important granular construction materials; however, since deposits in the Rowan Lake area appear to be small, the significance of the unit is limited.

Groundwater potential is low, since the deposits are relatively thin and probably above the water table. Where the water table is high, groundwater potential is excellent. Generally, this terrain unit is not suitable for waste disposal.

## 3.4 GLACIOLACUSTRINE

Examples: $\frac{\text{cmLP(RN)}}{\text{Lp-M}}$ $\frac{\text{sgLB/RN}}{\text{Lun-D}}$

Glaciolacustrine (LP) sediments occur mainly as small pockets in association with other terrain units. They are presumed to consist of varved silty clay (cmLP) and, in the Whitefish Bay area, include a distinctive band of maroon-coloured varved clay visible in road cuts. Drainage conditions vary from dry to wet (D, M, W). To the west of the map-area, near Sioux Narrows, Zoltai (1961) noted that varved clay underlies a clay till over a significant area.

Raised beaches consisting of sand and gravel (sgLB) occur south of Dirtywater Creek in the northwest corner of the area.

The fine-grained deposits of silt and clay make poor construction materials, so that importation of aggregate is often necessary. Transportation route construction and general near-surface construction are inexpensive due to the ease of excavation. However, because of the high percentage of silt, the deposits are frost susceptible. Glaciolacustrine deposits are relatively weak and have low bearing capacities and shearing resistances. Minor slumping and erosion occur along most streams and are important considerations in the design and construction of bridges.

Although the moisture content of the silt and clay is very high, groundwater potential is poor due to the low effective permeability and porosity of the unit. Shallow large bore wells may provide sufficient water for domestic use. Substantial buried-valley aquifers may occur below the glaciolacustrine unit in some places, but none were positively identified in this study. The terrain is suitable for septic drain tile fields and near-surface waste disposal, but the soil is difficult to work when frozen.

Sand and gravel beach deposits have considerable potential as sources of granular construction material, but are limited to the northwest corner of the map-area. Transportation routes and general construction can be carried out easily in beach terrain due to the availability of material and the existence of good foundation conditions. Groundwater potential is usually poor because most beaches occur above the water table, but where the water table is high, the groundwater potential is excellent. The beach deposits are not very suitable for waste disposal.

## 3.5 ORGANIC

Examples: $\frac{\text{pOT(RN)}}{\text{Lnp–M}}$ $\frac{\text{pOT}}{\text{Lp-W}}$ $\frac{\text{pOT/cmLP}}{\text{Lp-M}}$

Numerous organic deposits composed of peat (pOT) and silt occur in poorly drained depressions within the hilly bedrock terrain. Glaciolacustrine clay is believed to underlie the organic material in some cases, but sand and gravel (sgGO) may also occur beneath some of the bogs. Organic terrain is poorly drained (W), but some deposits appear to be dry during parts of the year (M).

Construction is difficult and expensive in organic terrain due to the poor drainage conditions and the low strength, low bearing capacity, high compressibility and extremely high frost susceptibility of the soil materials. The unit is generally poor for engineering or construction use, but light vehicle roads have been built with some success across some of the dryer deposits. Groundwater potential is low and the terrain is not suitable for waste disposal.

### 3.6 ALLUVIAL

Examples: $\frac{spAP}{Lp\text{-}M}$ $\frac{pAP}{Lp\text{-}M}$

Alluvial (AP) plains of a size large enough to be mapped are restricted to some small streams (e.g. Burnt Creek and Log River, both in the southwest corner of the area). The unit consists of sand(s) and peat (p) along valley bottoms and is wet (M or W) at least part of the year.

Alluvial plains are unsuitable for most engineering uses due to the poor drainage, characteristically high groundwater table, and periodic flooding. Groundwater potential is usually poor, since most alluvium in this map-area is fine grained. This terrain unit is not suitable for waste disposal.

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